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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/661,709	09/12/2003	Henry A. Blauvelt	XPNT22NP	8225

36394 7590 06/02/2005

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EXAMINER	
ELLIS, SUEZU Y	

ART UNIT	PAPER NUMBER
2878	

DATE MAILED: 06/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/661,709	BLAUVELT ET AL.
	Examiner	Art Unit
	Suezu Ellis	2878

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-68* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-68* is/are rejected.

7)☒ Claim(s) *24* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 September 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, in claim 14, the reflecting face and the photodetector active region separated by at least 5 μm at the substrate surface must be shown or the feature canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claim 24 objected to because of the following informalities: Claim 24 can be more clearly understood if rewritten as "between about 2.5 μm and 50 μm below a level of the photodetector active area". Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 14, 16-18, 24, 57-68 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to claim 14, it is unclear as to how the photodetector active region and the reflecting face are separated by at least 5 μm at the substrate surface. How are the photodetector active region and reflecting region separated? Is there a 5 μm distance between the tip of the reflecting face (since it is at the surface of the substrate) and the photodetector active region? Please clarify.

Claims 16 and 24 recite the limitation "the photodetector active area". There is insufficient antecedent basis for this limitation in the claim. Please replace with --photodetector active region--.

With respect to claim 17 and 18, lines 3-4 recite "a substantial vertical (non-vertical) plane of incidence relative to the reflecting face". Since the reflecting face is angled, is the vertical plane (non-vertical plane) the direction of the incident light normal (not normal) to the reflecting face? Further, if it is defined as the direction of incident light normal (not normal) to the reflecting face, a direction of light is not the same as a plane of light. Please define what the vertical (non-vertical) plane of incidence is. For examining purposes, the vertical plane of incidence will be considered as the direction of the incident light normal to the reflecting face.

Claim 57 recites the limitations "the transmission member" and "the reflecting face" in lines 6-7. There is insufficient antecedent basis for this limitation in the claim. Further the claim recites "a low-index optical medium" in line 4. It is unclear what "low-index" is considered as. Is the index low relative the index of the substrate material and what is the range or number to be considered as low? Please define the term "low-index". For examining purposes, "low-index optical medium" will be defined as an optical medium with a refractive index lower than that of the substrate material.

Claims not specifically addressed are indefinite due to their dependency on an indefinite claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-5, 7, 8, 10-12, 14-16, 19, 21, 27-32, 34, 35, 37-39, 41- 43, 46, 47, 49, 55, 57, 58 and 67 are rejected under 35 U.S.C. 102(e) as being anticipated by Fukano (US 6,353,250).

With respect to claim 1, Fukano teaches the structure as claimed by the applicant in Fig. 25. Fig. 1 and 25 show a semiconductor substrate (215) with a substrate surface, an entrance face (side opposite the reflecting face) formed on the substrate and at an angle with the substrate surface, a photodetector active region (212-214) formed at the substrate, and a reflecting face (211) formed on the substrate and at an acute angle with the substrate surface. Although Fukano fails to expressly disclose the optical beam being transmitted via entrance face and reflected at the reflection face so that the optical beam impinges on the photodetector active region, the structure illustrates the capability to do so.

With respect to claims 2-3, Fukano discloses the photodiode being a p-I-n photodiode comprising and InP n-layer (214), an InGaAs layer (213) and an InP p-layer (212) (col. 36, lines 36-40).

With respect to claim 4, Fukano discloses a photodetector active region comprising a structure that is used in an avalanche photodiode (col. 37, lines 49-55).

With respect to claims 5 and 7, Fukano illustrates in Fig. 25, the entrance face forms an angle of 90°.

With respect to claims 10 and 12, Fukano discloses in Fig. 35 the reflecting face forms an angle (mesa angle) with the substrate surface at about 55° (col. 52, lines 57-60).

With respect to claims 8, 11 and 67, Fukano discloses the reflecting face is coated with an anti-reflection coating, thus allowing the capability for total internal reflection to occur at the reflection face (col. 24, lines 5-15).

With respect to claim 14, Fukano discloses the photodetector active region and the tip of the reflecting face are 8 μm apart (col. 39, lines 55-57).

With respect to claim 15, Fukano discloses the entrance face and the reflecting face are separated by 70 μm (col. 21, line 49).

With respect to claim 16, Fukano discloses in Fig. 2, two electrical contacts (16, 17) formed at the substrate surface and connected to the photodetector active area.

With respect to claim 19, Fukano discloses that the reflecting face is substantially parallel to a crystal plane (111) of the substrate (col. 36, lines 42-45).

With respect to claims 21, Fukano discloses in Fig. 26, a transmission optical element (optical waveguide - 228) is positioned on a second substrate (pedestal - 230), where the semiconductor substrate is mounted on the second substrate with the substrate surface facing the second substrate.

With respect to claim 27, Fig. 19 illustrates a groove formed in the substrate and an optical fiber mounted on the substrate in the groove.

With respect to claim 47, Fukano discloses the reflecting face is formed via an etch process that is selective for (-1-11) and (111) planes which are non-parallel to the crystal plane of the substrate and the reflecting face is formed along the (111) plane (col. 21, lines 55-58).

With respect to claim 57, Fukano discloses in Fig. 28, a semiconductor substrate, a photodetector active region formed on the substrate, and a low-index optical medium formed on the semiconductor substrate with an internal reflector positioned at the photodetector active region. This structure further illustrates the capability for an optical beam to propagate within a transmission member and be internally reflected from the reflector onto at least a portion of the active region.

With respect to claim 58, Fukano further discloses the low-index optical medium which is in the optical path, thus is light transparent, and the medium can be made of polyimide, which is well known to be a dielectric material (col. 46, lines 27-21).

With respect to claims not specifically addressed, the method of making is inherent to the apparatus.

Claims 1, 18, 20, 28, 45, 48 are rejected under 35 U.S.C. 102(b) as being anticipated by Spaeth et al. (US 5,218,223). Hereinafter, Spaeth et al. will be referred to as Spaeth.

With respect to claim 1, Spaeth discloses in Fig .1a semiconductor substrate (6) having a substrate surface (3) comprising an entrance face (4, left) which forms an angle with the substrate surface, a reflecting face (4, right) which forms an acute angle with the substrate surface, and a photodetector active region which is positioned so that at least a portion of an optical beam internally reflected from the reflecting face will impinge upon the photodetector active region.

With respect to claim 18, Spaeth discloses in Fig. 3 the entrance face and the reflecting face are arranged so that an optical beam can be transmitted through at a normal incidence (parallel to the substrate) and the beam is reflected at a non-normal angle relative to the reflecting face.

With respect to claim 20, Spaeth discloses in Fig. 3, the entrance face can be convex.

With respect to claims not specifically addressed, the method of making is inherent to the apparatus.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 23, 26, 51, 52, 54, 59, 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukano.

With respect to claim 23, Fukano addresses all the limitations of claims 1 and 21. Fukano further discloses the optical waveguide is an optical fiber which is mounted on the second substrate. However, the modified Fukano fails to expressly disclose the optical fiber is mounted in a groove on the second substrate. It would have been obvious to a person of ordinary skill in the art to include a groove in the second substrate in order to align the optical fiber with the apparatus.

With respect to claim 26, Fukano addresses all the limitations of claims 1 and 21. Fukano further discloses in Fig. 28 another embodiment wherein the semiconductor substrate and the end face of the transmission optical element are encapsulated with a medium. It would have been an obvious design choice to a person of ordinary skill in the art to encapsulate the semiconductor substrate and the end of the transmission optical element in order to change the refraction of the light as desired.

With respect to claim 59, Fukano addresses all the limitations of claims 57 and 58. In another embodiment (Fig. 26), a transmission optical element (optical waveguide - 228) is positioned on a second substrate (pedestal - 230), where the semiconductor substrate is mounted on the second substrate with the substrate surface facing the second substrate. It would have been an obvious design choice to a person of ordinary skill in the art to modify the apparatus of Fig. 28 to have a transmission optical element positioned on a second substrate where the semiconductor substrate is mounted on the second substrate with the substrate surface facing the second substrate, as another means to secure both the apparatus and waveguide, thus prevent shifting.

With respect to claim 61, the modified Fukano addresses all the limitations of claims 57 and 59. The modified Fukano discloses the optical waveguide being an optical fiber, but fails to expressly disclose the fiber is mounted in a groove on the second substrate. However, it would have been obvious to a person of ordinary skill in the art to include a groove in the second substrate in order to align the optical fiber with the apparatus.

With respect to claims not specifically addressed, the method of making is inherent to the apparatus.

Claims 17 and 44 are rejected under 35 U.S.C. 102(b) as being anticipated by Spaeth.

With respect to claim 17, Spaeth addresses all the limitations of claims 1 and 28, however fails to expressly disclose the entrance face and the reflecting

face are arranged so that an optical beam can be transmitted through at a normal incidence (parallel to the substrate) and the beam is reflected at a normal angle relative to the reflecting face. However, it would have been an obvious design choice to modify the reflecting face so that the reflected angle would be normal to the angle face in order to enhance the deflection onto the photodetector active region as desired.

Claim 44 is inherent to the apparatus of claim 17.

Claims 6, 13, 24, 25, 33, 40, 52, 53, 68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukano in view of Spaeth.

With respect to claim 6, Fukano addresses all the limitations of claims 1 and 5, however fails to disclose an incident optical beam propagating substantially parallel to the substrate surface and transmitted through the entrance face into the substrate is refracted away from the substrate surface. Fukano and Spaeth are directed towards a similar field of endeavor of semiconductors with internal reflectors. Spaeth discloses in Fig. 3, an optical beam transmitted substantially parallel through a planar entrance face and is refracted away from the substrate surface. It would have been obvious design choice to a person of ordinary skill in the art to include an incident optical beam that propagates substantially parallel to the substrate surface so that the transmitted light is refracted away from the substrate surface so that the light beams can be reflected in a nearly perpendicular direction to the photodetector active region (col. 4, lines 17-25).

With respect to claims 13 and 68, Fukano addresses all the limitations of claims 1, 10 and 57, however fails to expressly disclose the reflecting face including a reflective coating. Spaeth teaches it is well known in the art to include a mirroring or silvering coating on the surface of the reflecting face (col. 3, line 65 – col. 4, lines 2). It would have been obvious to a person of ordinary skill in the art to include a reflective coating on the reflecting face in order to enhance the deflection toward the photodetector active region.

With respect to claim 24, Fukano addresses all the limitations of claims 1 and 21, however fails to expressly disclose the optical beam is centered on the entrance face between about 2.5 μm and 50 μm below the level of the photodetector active region. Spaeth teaches it is well known in the art for the optical beam to be transmitted via an entrance face, but also fails to expressly disclose the beam being centered on the entrance face between about 2.5 μm and 50 μm below the level of the photodetector active region. However, since the reflecting face is slanted, the placement of the optical beam will determine where along the slant the optical beam will hit and thus will assist in controlling where along the photodetector active region the beam will be directed towards. Thus it would have been obvious to a person of ordinary skill in the art to modify the beam to be placed between about 2.5 μm and 50 μm below the level of the photodetector active region in order to enhance the reflection toward the photodetector active region.

With respect to claim 25, Fukano addresses all the limitations of claims 1 and 21. Fukano teaches it is well known for a light transparent medium to be

placed within the optical path. However, Fukano fails to disclose the optical path being between the end face of the transmission optical element and the entrance face. Spaeth teaches it is well known in the art for light to enter via an entrance face. It would have been obvious to a person of ordinary skill in the art to include a light transparent medium to be placed within the optical path between the end of the transmission optical element and the entrance face order to modify the refraction angle at the entrance face as desired.

With respect to claims not specifically addressed, the method of making is inherent to the apparatus.

Claims 22, 60 and 62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukano in view of Yoshimura et al. (US 5,999,670). Hereinafter, Yoshimura et al. will be referred to as Yoshimura.

With respect to claims 22 and 60, Fukano/the modified Fukano addresses all the limitations of claims 1, 21, and 57-59. However, Fukano fails to expressly disclose the transmission optical element being a planar waveguide. Fukano and Yoshimura are directed to a similar problem solving area of guiding light to a photodetector. Yoshimura teaches it is well known in the art for optical waveguides to be either a planar waveguide or a fiber optical waveguide (col. 1, lines 13-22). It would have been an obvious design choice to a person of ordinary skill in the art to make the waveguide planar since both types are interchangeable and the planar waveguide provides a more compact system.

With respect to claim 62, the modified Fukano addresses all the limitations of claims 57. Fukano discloses the optical medium encompassing the end of an optical waveguide, however fails to expressly disclose the waveguide is a planar waveguide. Yoshimura teaches it is well known in the art for optical waveguides to be either a planar waveguide or a fiber optical waveguide and to be positioned on a substrate (col. 1, lines 13-22). It would have been an obvious design choice to a person of ordinary skill in the art to make the waveguide planar since both types are interchangeable and the planar waveguide provides a more compact system.

With respect to claim 63, the modified Fukano addresses all the limitations of claims 57 and 62. The modified Fukano discloses in another embodiment (Fig. 26), a transmission optical element (optical waveguide - 228) positioned on a second substrate (pedestal - 230), where the semiconductor substrate is mounted on the second substrate. It would have been an obvious design choice to a person of ordinary skill in the art to modify the apparatus of Fig. 28 to have a transmission optical element positioned on a second substrate where the semiconductor substrate is mounted on the second substrate, as another means to secure both the apparatus and waveguide, thus prevent shifting. However, the modified Fukano fails to expressly disclose optical power propagating through the transmission optical element on the second substrate into the planar waveguide on the semiconductor substrate. Yoshimura discloses in Fig. 15, a planar waveguide positioned on a substrate wherein a laser beam enters the waveguide at the entrance face and is deflected via the deflector (end face) onto

a photodiode (col. 17, line 62-col. 18, line 10). It would have been obvious to a person of ordinary skill in the art to modify the structure of Fukano to have a planar waveguide positioned on a substrate as a more compact structure. Yoshimura further discloses it is well known in the art for current to propagate through the waveguides in order to measure the power of the laser beam. Note, power and current are interchangeable via the equation P=IV. Thus, it would be an obvious design choice to a person of ordinary skill in the art to have power or current propagating through the waveguide.

With respect to claim 65, the modified Fukano addresses all the limitations of claims 57, 62 and 63. However, Fukano fails to expressly disclose the transmission optical element being a planar waveguide. Yoshimura teaches it is well known in the art for optical waveguides to be either a planar waveguide or a fiber optical waveguide (col. 1, lines 13-22). It would have been an obvious design choice to a person of ordinary skill in the art to make the waveguide planar since both types are interchangeable and the planar waveguide provides a more compact system.

With respect to claim 66, the modified Fukano addresses all the limitations of claims 57, 62 and 63. The modified Fukano discloses the optical waveguide being an optical fiber, but fails to expressly disclose the fiber is mounted in a groove on the second substrate. However, it would have been obvious to a person of ordinary skill in the art to include a groove in the second substrate in order to align the optical fiber with the apparatus.

Claim 64 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fukano in view of Yoshimura and further in view of the teachings of Painter et al. (US 2002/0122615). Hereinafter, Painter et al. will be referred to as Painter.

With respect to claim 64, the modified Fukano addresses all the limitations of claims 57, 62 and 63. However, Fukano fails to expressly disclose the transmission optical element being a planar waveguide formed on the second substrate and transverse-coupled with the planar waveguide on the semiconductor substrate. Yoshimura teaches it is well known in the art for optical waveguides to be either a planar waveguide or a fiber optical waveguide (col. 1, lines 13-22). It would have been an obvious design choice to a person of ordinary skill in the art to make the waveguide planar since both types are interchangeable and the planar waveguide provides a more compact system. Fukano and Yoshimura both fail to expressly disclose the planar waveguide on the second substrate is transverse-coupled with the planar waveguide on the semiconductor substrate. However, it would have been an obvious design choice to a person of ordinary skill in the art to transverse-couple the two waveguides in order to improve the optical power transfer, as taught by Painter ([0067], lines 16-20).

Telephone/Fax Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Suezu Ellis whose telephone number is 571-

272-2868. The examiner can normally be reached on 8:30am-7pm (Monday-Thursday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dave Porta can be reached on 571-272-2444. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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